US005531344A

United States Patent [19]

Winner

[11] Patent Number: 5,531,344

[45] Date of Patent: Jul. 2, 1996

[54] **ACTUATOR FOR A PERSONAL PROTECTIVE SPRAY CANISTER**

[75] Inventor: **James E. Winner**, Hollywood Beach, Fla.

[73] Assignee: **Winner International Royalty Corporation**, Sharon, Pa.

[21] Appl. No.: **337,753**

[22] Filed: **Nov. 14, 1994**

[51] **Int. Cl.**[6] **G01F 11/00**

[52] **U.S. Cl.** **222/1**; 222/402.1; 222/504; 222/649; 239/289; 340/574

[58] **Field of Search** 222/1, 402.1, 504, 222/649; 239/62, 69, 70, 274, 289, 526; 109/29, 32; 340/574

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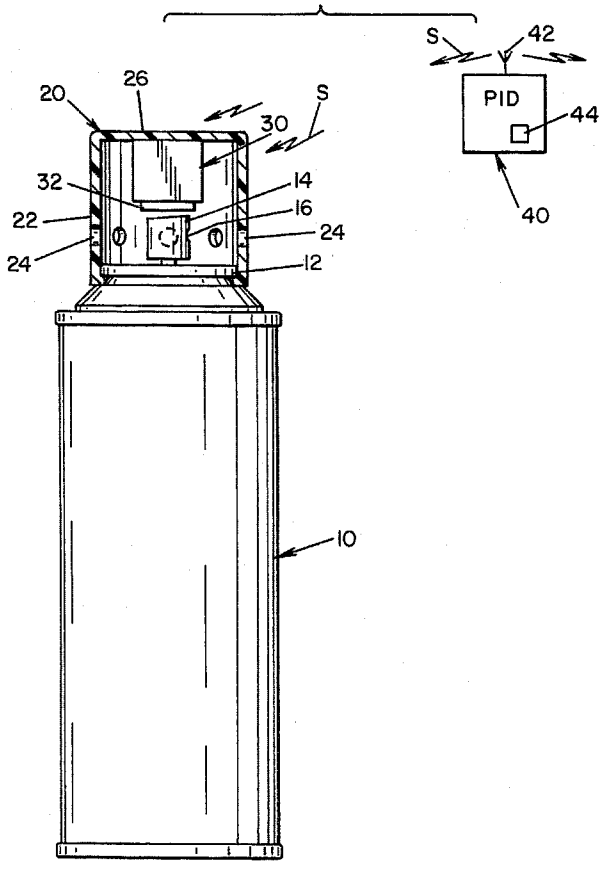
Primary Examiner—Andres Kashnikow
Assistant Examiner—Joseph A. Kaufman
Attorney, Agent, or Firm—Vickers, Daniels & Young

[57] **ABSTRACT**

An actuator for a personal protective spray canister having a container for holding a pressurized protective material capable of being propelled in a gaseous cloud to at least partially disable a person and a manipulative valving device protruding outwardly from the container, with the valving device having an outlet for directing the gaseous cloud from the container, and a valve element movable between a first biased normal position closing the outlet and a second depressed operative position opening the outlet to allow the material to be propelled from the container as a cloud. The actuator comprising: a radio frequency receiver for detecting and receiving a coded radio frequency signal, a decoder for creating an identification signal when the receiver receives a radio frequency signal with a preselected code, a mechanical device for moving the valve element into the second depressed, operative position in response to a danger signal, a circuit for creating a danger signal in response to a given number of identification signals, a power supply for providing power to operate the mechanical device to depress the valve element when the actuator is operatively associated with the valve element of the container.

31 Claims, 6 Drawing Sheets



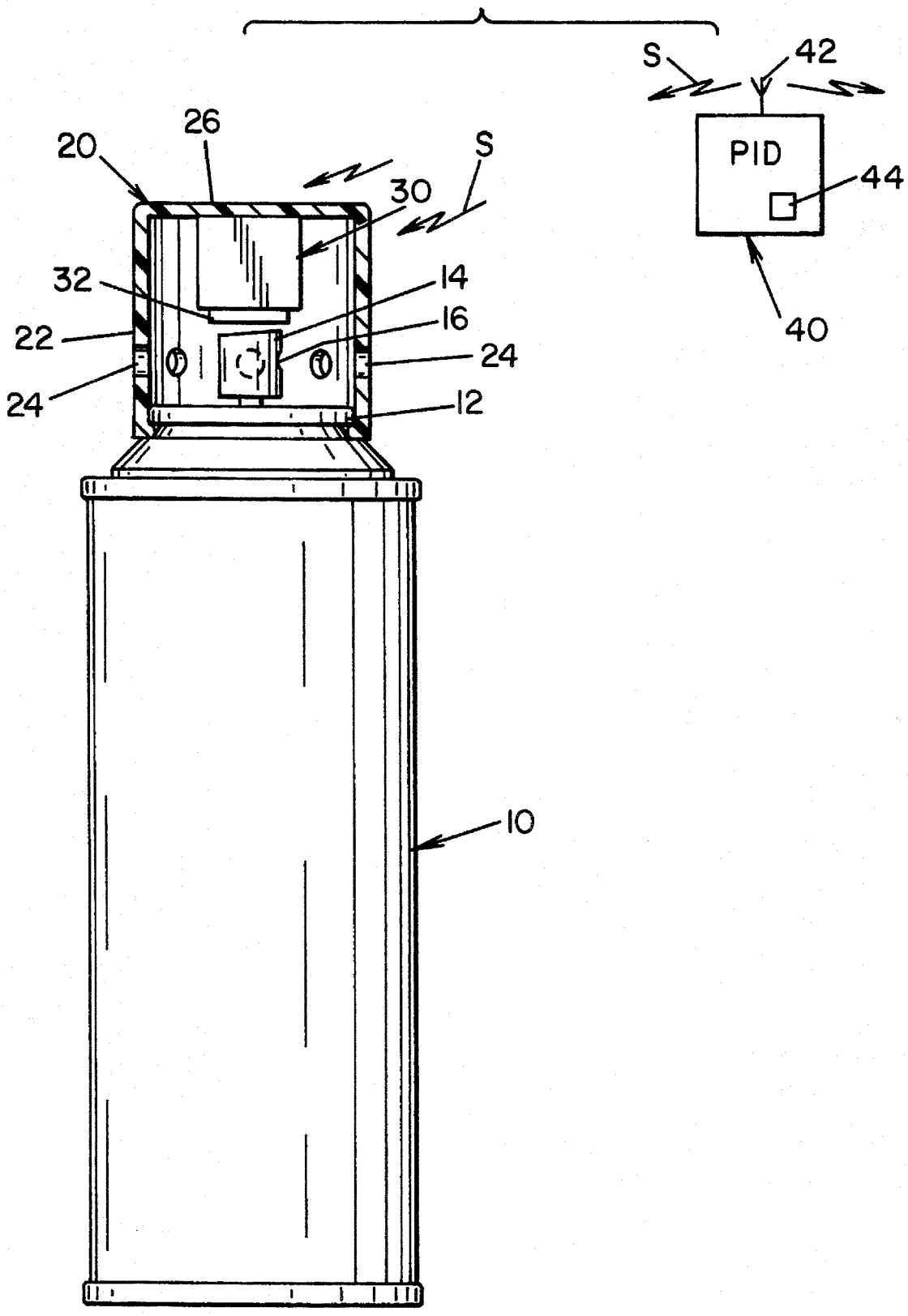


FIG. 1

FIG. 2

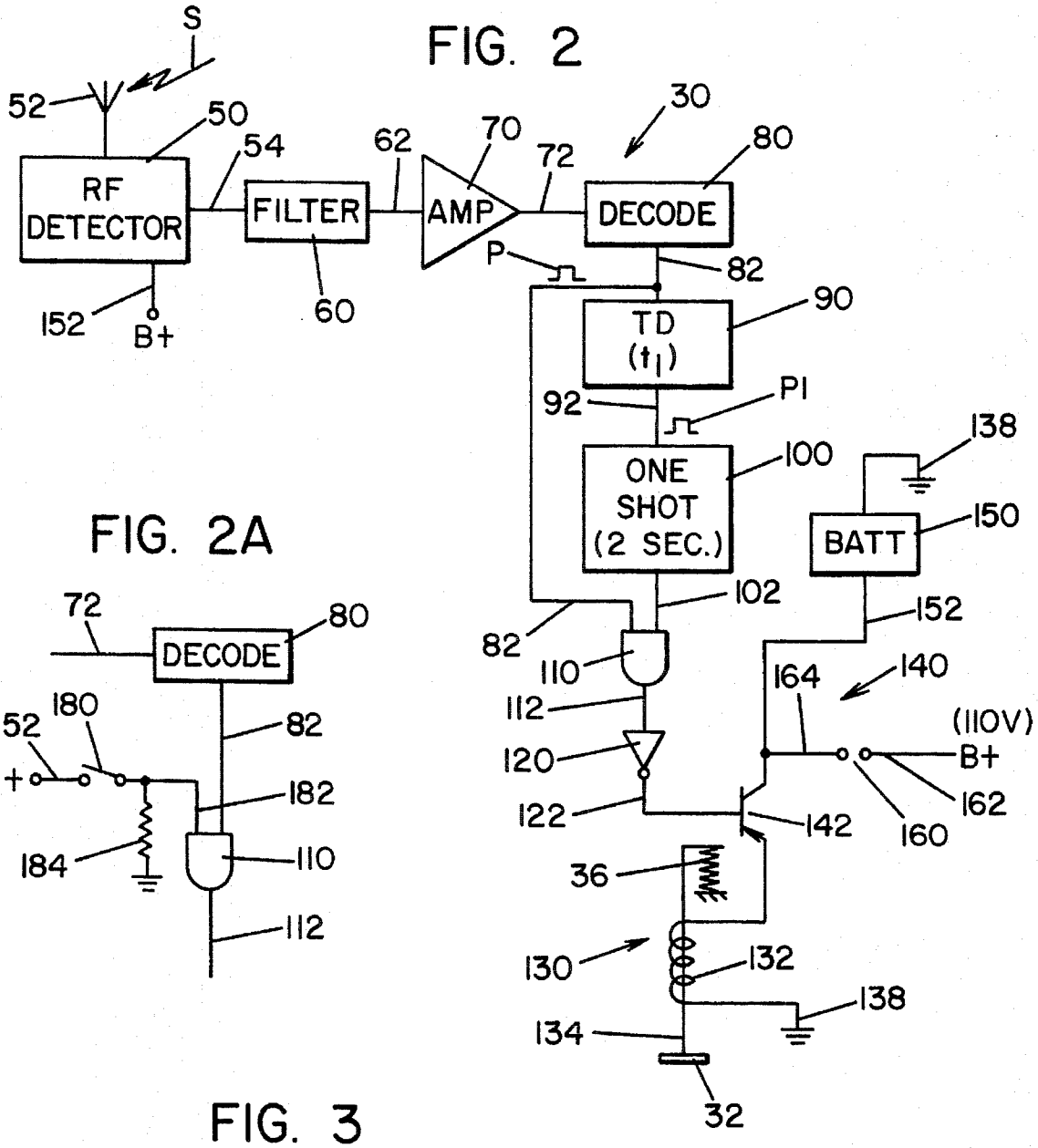


FIG. 2A

FIG. 3

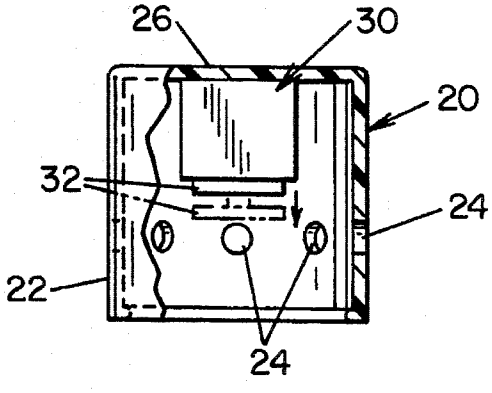


FIG. 4

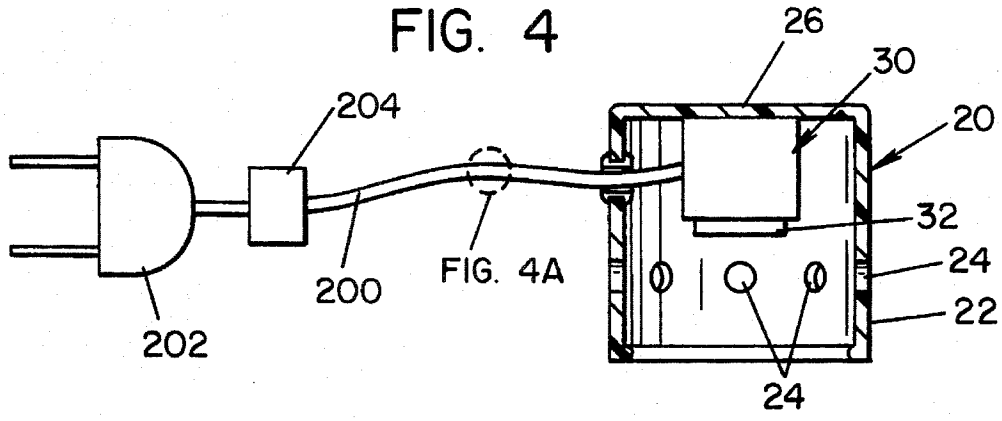
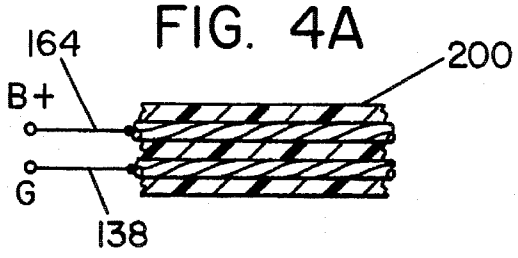


FIG. 4A



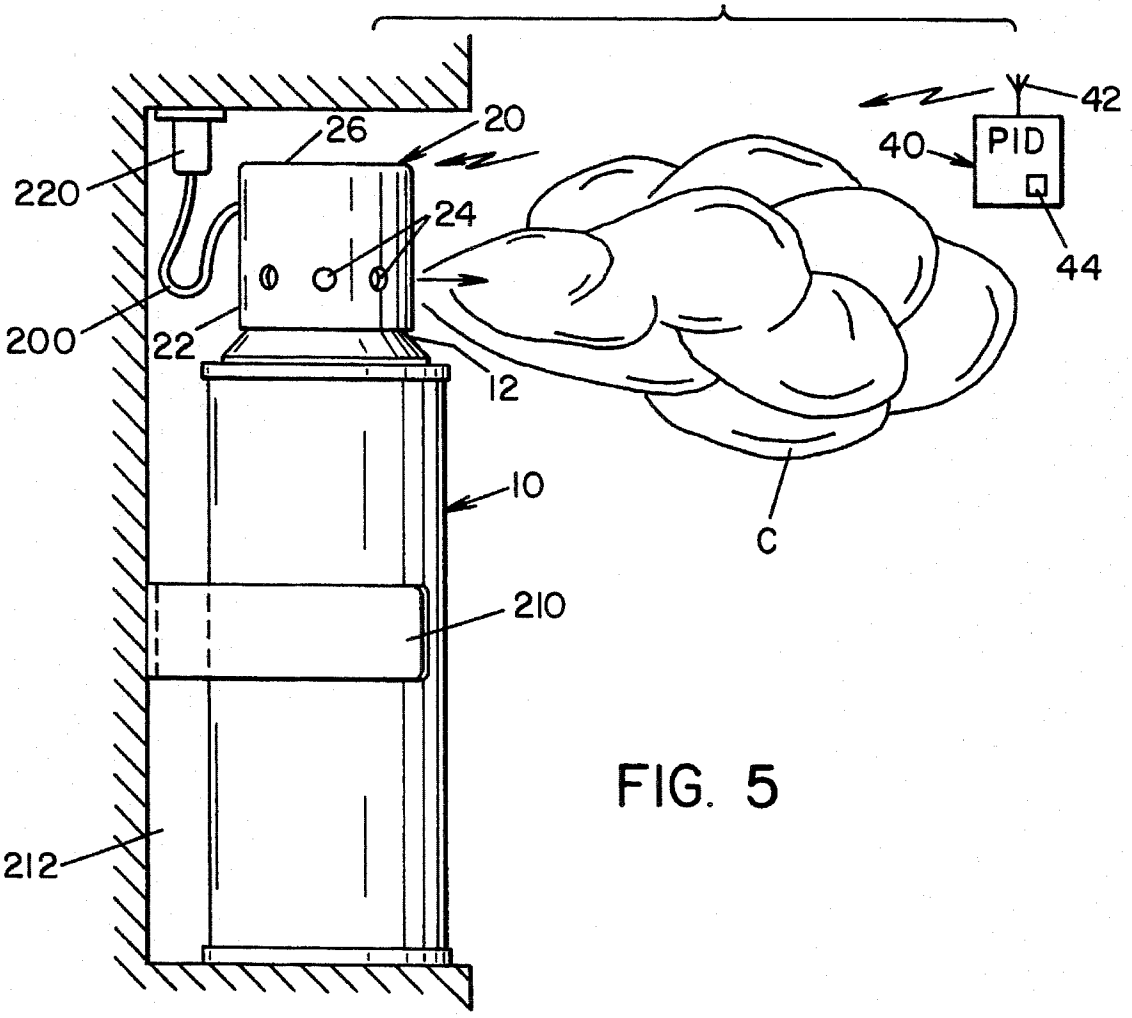


FIG. 5

FIG. 6

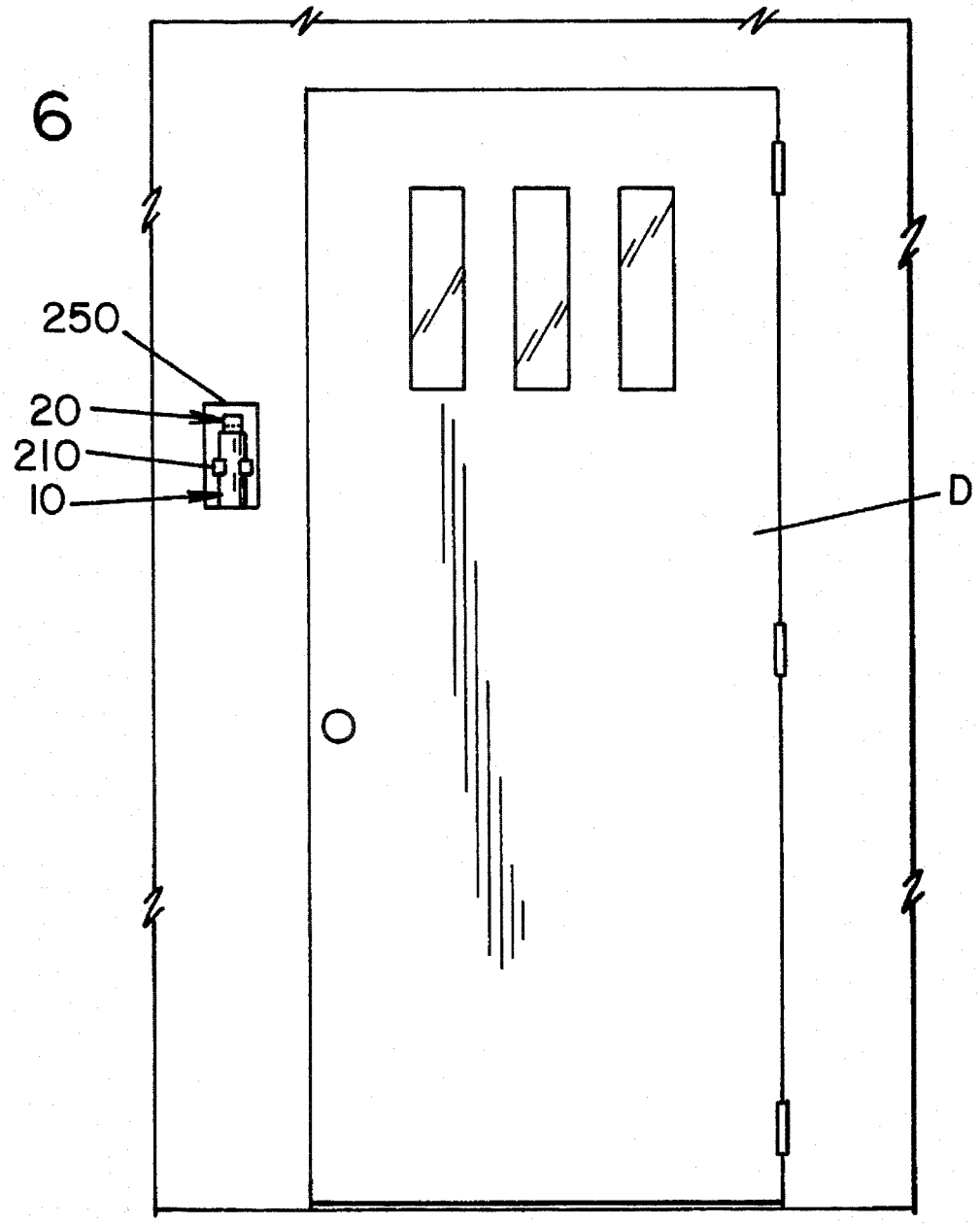
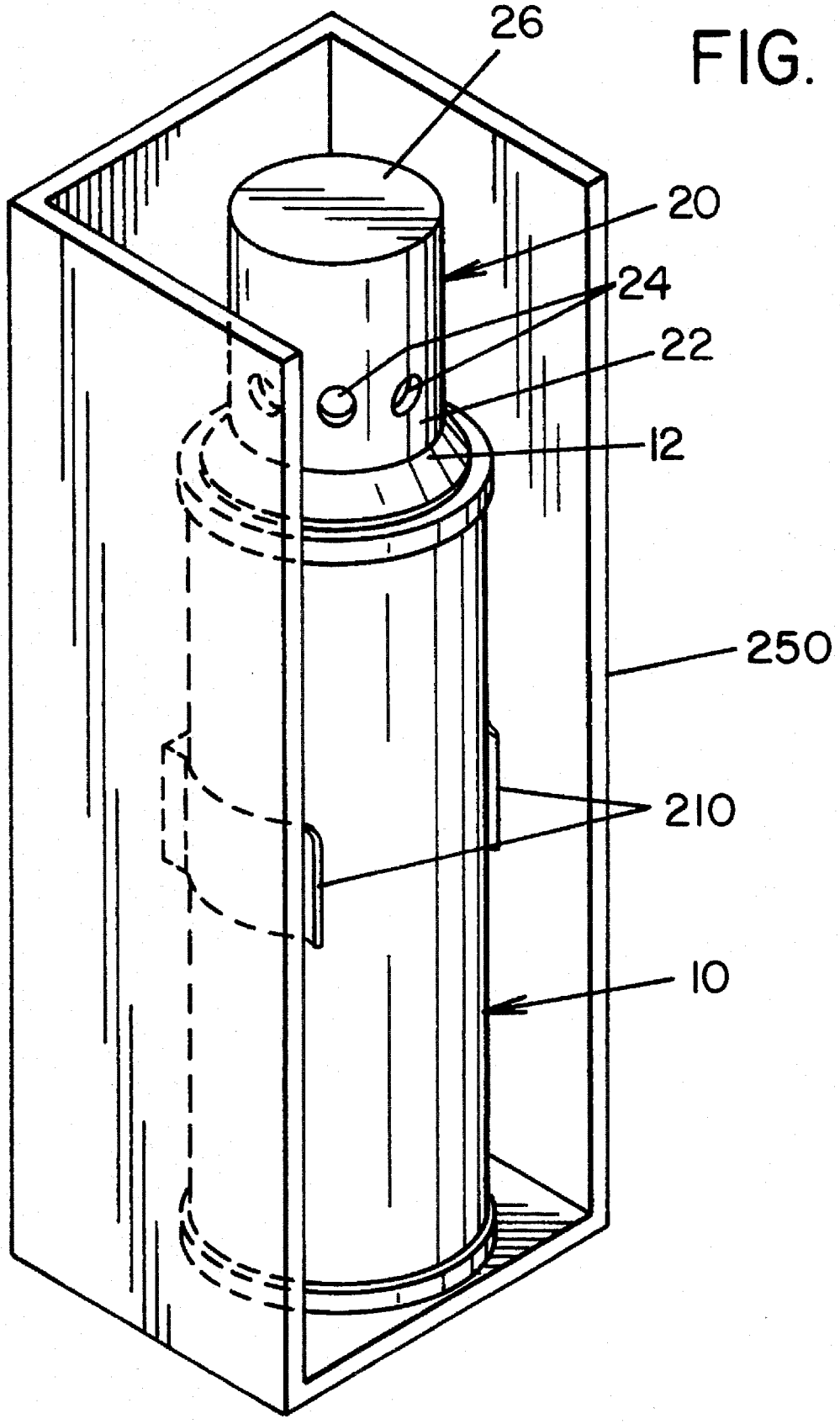


FIG. 6A



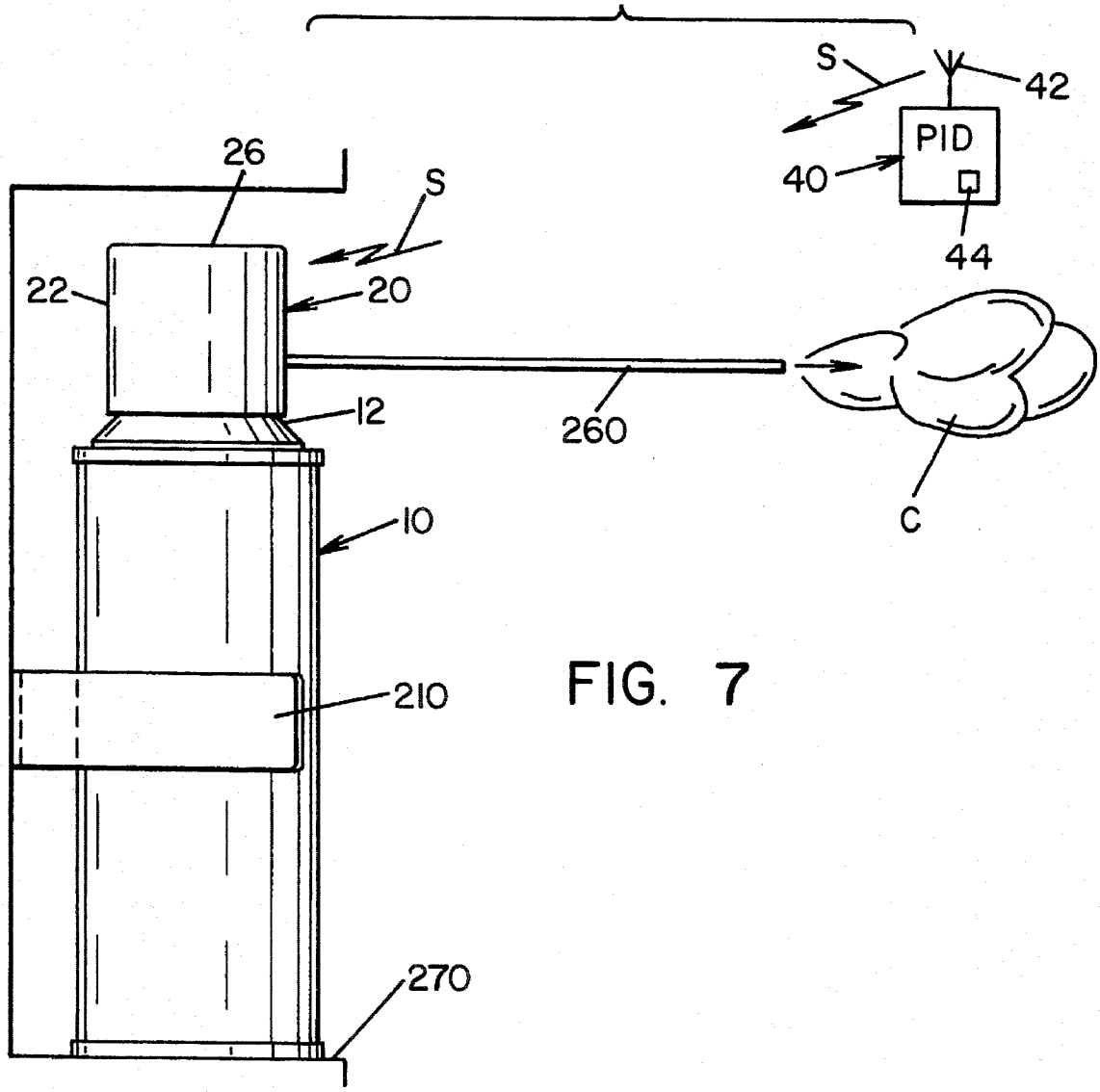


FIG. 7

ACTUATOR FOR A PERSONAL PROTECTIVE SPRAY CANISTER

This invention relates to the art of protective spray canister devices, such as a pepper base spray and mace, and more particularly to an actuator for a personal protective spray canister.

BACKGROUND OF INVENTION

It has become quite popular to use protective spray canisters of the type including a container with a pressurized protective material capable of being propelled in a gaseous cloud toward a threatening individual. The pressurized protective material can take a variety of forms, the most popular of which is a pepper based spray wherein a pressurized repellant carries, in a cloud, particulate material which debilitates an individual upon contact. Of course, other types of protective material, such as mace, are also employed in aerosol canister form. These canisters are normally carried in belt loops or purses and have a manipulative valving device protruding outwardly from the container so a person wanting to ward off imminent attackers can depress a valve element in the valving device to release a directional cloud of protective gaseous material. The valving element is biased upwardly into the closed position and is manually manipulated by depressing the valve element into a second position, which is the operative position for opening the outlet of the valving device, to allow the gaseous material to be propelled from the container toward the would-be attacker. Many of these personal protective spray canisters are now carried on persons for security purposes.

THE INVENTION

In the past, a disadvantage of the personal protective spray canister devices is that the user has only a very short time to actuate the protective spray or cloud before an attacker accomplished their sinister plan. In accordance with the present invention, the personal protective spray canister is operable from a remote location so the user may be a long distance from the canister when it is used to intercept and debilitate a would-be attacker or other criminal element to reduce the likelihood of personal injury by such criminal element. In accordance with the present invention, a standard canister is provided with a releasable cap having a cylindrical skirt for mounting the cap on the container over the valve element. A mechanical means carried by the cap itself is used to move the valve element into the second, or operative, position in response to a danger signal caused by a remotely created trigger signal having a preselected identification binary code and received by the cap. In a more limited detail, the mechanical means on the cap is a solenoid mounted on the end wall of the cap and having a plunger for moving the valve element into the second, operative position in response to the aforementioned danger signal. In accordance with a more detailed aspect of the present invention, the protective spray canister is provided with an actuator, including a radio frequency receiver means for detecting and receiving a coded radio frequency signal, a decoder means for creating an identification signal when the receiver means receives a radio frequency signal with a preselected code, mechanical means for moving the valve element into the second, depressed, operative position in response to a danger signal, means for creating a danger signal in response to a given number of identification signals, electrical means or power supply for providing electrical power to operate the mechanical means to depress the valve element and means for mounting the actuator onto the container with the mechanical means operatively associated with the valve element. In this detailed aspect of the device, the actuator is a releasable cap having a cylindrical skirt which is the mounting means for mounting the actuator onto the canister. The cap itself includes the electrical power supply which is a cadmium type battery mounted on the cap. In some instances, the cap or the actuator can be plugged into either the automobile battery power supply or a normal house current power supply. In any of these arrangements, the actuator receives a coded signal to operate a solenoid for forcing a plunger against the top of the valve element of a standard protective spray container to eject a protective spray or cloud while the operator is at a remote location.

The coded signal, in accordance with the present invention, is provided by a standard personal identification device (PID) which is often used for automotive security systems. Any one of a variety of personal identification devices can be used in practicing the invention. Such personal identification devices transmit radio frequency signals with binary codes that are unique to the owner of the personal identification device. By depressing a button on the PID the user has heretofore been able to turn on lights in his car, disable the security system, open trunks and perform various selected safety or security functions. Each personal identification device has a unique preselected binary code. This same code is programmed into the actuator constructed in accordance with the present invention for remote actuation of the protective spray canister.

In accordance with another aspect of the present invention, there is provided an electrical circuit for preventing inadvertent actuation of the canister from a remote location. This circuit can take a variety of forms. In the preferred embodiment, a selected number of coded signals must be received by the canister actuator in a very short time to actuate the canister. Each signal is indicative of a manual operation of the personal identification device held by the user. Consequently, the operating device must be manually pulsed rapidly to create the selected number of coded signals within a relatively short period of time. In practice, two depressions within less than two seconds are required for the purpose of causing the actuator to release the defensive spray or cloud. In accordance with another aspect of this invention, a manual switch can be used with the actuator to arm the actuator so a single coded signal can cause the protective spray or cloud only when the actuator is enabled by the manually operated switch. This switch could also be used as a means for enabling or disabling the actuator.

The actuator of the present invention is preferably a cap with a battery and the necessary circuitry. The cap is placed over a standard spray canister and operated by a standard personal identification device. The invention is more broad and could be used with an actuator mounted adjacent the entrance door of an apartment or other domestic dwelling. The actuator can be mounted in a vehicle. The actuator, in one form is separate from the canister. In the preferred form the actuator is a removable cap for the canister. The broadest aspect of the present invention is the mounting of an actuator device for remote operation of a protective spray canister, wherein the remote actuating device includes a transmitter for transmitting a coded signal which is unique to the particular actuator and to the particular user associated with the actuator.

The primary object of the present invention is the provision of an actuator for a protective spray canister of the type used for pepper spray, which actuator is operated from a

remote location by a person identification device of the type creating a unique coded high frequency signal in response to manual manipulation of the personal identification device.

Yet another object of the present invention is the provision of a method for operating a protective spray canister, which method involves the step of moving the valve element in the canister into the propellant position in response to a danger signal created by a remotely created trigger signal having a preselected code.

Still a further object of the present invention is the provision of an actuator for a personal protective spray canister which actuator can be operated remotely so that the canister may be mounted at various positions, such as at the entrance door of an apartment or house, within a vehicle or at any other strategic, selected location to be secured.

Yet another object of the present invention is the provision of an actuator for a personal protected spray canister, as defined above, which actuator is self-contained in a cap to be placed over the canister.

These and other objects and advantages will become apparent from the following description using the drawings hereinafter described.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevational view of the preferred embodiment of the present invention with the container cap actuator in cross section;

FIG. **2** is a block diagram showing the preferred embodiment of the electrical circuitry mounted in the cap of the preferred embodiment shown in FIG. **1**;

FIG. **2A** is a partial circuit diagram showing a modification of the circuit illustrated in FIG. **2** for using a switch to enable the actuator of the present invention;

FIG. **3** is a cross section of the canister cap, shown in FIG. **1**, illustrating the operation of the plunger for moving the valve element of the canister into the opened position;

FIG. **4** is a generally cross-sectional view of a modification of the preferred embodiment of the present invention where the actuator is powered by either the house power supply when the actuator is mounted adjacent an entrance door or the vehicle battery power supply when the actuator is mounted in a vehicle;

FIG. **4A** is an enlarged partial view of the circled area in FIG. **4** showing the electrical power supply cord including a voltage positive line as well as a ground line;

FIG. **5** is a view similar to FIG. **1** illustrating the use of the modification as illustrated in FIG. **4** in a vehicle;

FIG. **6** is a front plan view of a domestic entrance door with the embodiment of the invention shown in FIG. **1** mounted adjacent the entrance door;

FIG. **6A** is an enlarged pictorial view of the mounting arrangement for the preferred embodiment of the present invention in the use illustrated in FIG. **6**; and,

FIG. **7** is a side elevational view of a modification of the preferred embodiment of the present invention as best shown in FIG. **5**, wherein a tubular element is employed for directing the protective cloud or spray of debilitating gaseous material.

PREFERRED EMBODIMENTS

Referring now to the drawings wherein the showings are for the purpose of illustrating the preferred embodiment of the invention, and not for purposes of limiting same, FIGS. **1** and **3** show a standard personal protective spray canister such as a pepper spray aerosol canister **10** having a top **12** with an outwardly extending valve element **14** having a gas projecting opening **16**. In practice, valve element **14** is often located between two partitions so that only a finger can be employed in a very particular manner for operating valve element **14** and allowing projection of the cloud of gaseous material from opening **16**, as shown in FIG. **5**. For simplicity, the upper projected valving element is illustrated as merely an outwardly projecting device, such as used on a standard aerosol spray container to cause the projected spray. This valve element is used for simplicity and to better illustrate the present invention, which invention is not directed to any particular type of valving element, as long as the valving element is biased in the closed position and mechanically movable into the open position. As so far explained, canister **10** is standard and includes a container for holding a pressurized protective material capable of being propelled in a gaseous cloud to at least partially disable a person. This cloud can be mace, but is preferably a pepper based spray. Valving device **14** is manually manipulative and protrudes outwardly from the container. This valving element, or valve device, includes outlet **16** for directing the gaseous cloud from the container. The valving element, or device, is moved between a first biased, normal position closing outlet **16** and a second, depressed operative position opening outlet **16** to allow the gaseous material to be propelled from the container **10** as a directed cloud. In accordance with the present invention, cap **20** includes a cylindrical skirt **22** mounted over the top **12** of container **10** and having a plurality of circumferentially spaced openings **24**. Cap **20** also includes an outer end wall **26** for mounting actuator mechanism **30** having a plunger **32**, which is movable as illustrated in FIG. **3** between the solid line inactive position to the depressed active position, shown in phantom lines. The actuator is the cap or can be considered as being mounted on the cap. The cap is plastic and is provided with an appropriate antenna arrangement for receiving a high frequency digitally coded signal from a standard personal identification device **40**. This PID device includes a transmitter **42** for transmitting radio frequency coded signal S from a remote position to cap **20** containing actuator mechanism **30**. As so far described, an operator depresses button **44** of the personal identification device **40** in rapid succession to send a series of rapidly created binary coded signals S toward the actuator **30** of cap **20**. Upon identification of signal S, the PID **40** is known to be the proper actuating device. Then actuator **30** causes plunger **32** to be driven downwardly as shown in FIG. **3**. This propels a cloud of protective gas from canisters **10** from upwards of 50 to 100 feet. This is the normal range of a PID transmitting device now used for operating vehicle components from remote locations.

A variety of circuits could be incorporated for use with actuator **30**; however, in the preferred embodiment illustrated in FIG. **2**, actuator **30** includes a radio frequency detector **50** having an antenna **52** which is formed as a part of plastic cap **20**. As is known, a very small antenna is required for receiving binary coded radio frequency trigger signals S. Output **54** of detector **50** directs all radio frequency signals to filter **60**, which has a pass band tailored to the carrier frequency of PID **40**. Output **62** of filter **60** directs the carrier signal to which filter **60** is tailored through amplifier **70** for producing a coded signal in line **72**. The signal in line **72** will only be any carrier signal from a PID having the same frequency as PID **40**. A standard binary decoder **50** is set, according to standard practice, to the

unique binary code of the actual PID **40** of the person associated with canister **10**. When decoder **80** receives a signal in line **72** which signal matches the preset binary code of decoder **80**, a pulse P appears in output line **82**. This pulse has a relatively short duration and is directed to the input of time delay device **90**. This time delay device has a delay which is slightly greater than the time duration of pulse P. Consequently, pulse P disappears before time delay device **90** creates a signal in its output line **92**. This signal in line **92** is another pulse labeled P1. Pulse P1 is relatively short in duration and initiates a one shot device **100** to hold a logic 1 in output line **102** for a preselected time. In the preferred embodiment this time is about 2.0 seconds. This timing is a matter of choice, but should be relatively short so that the actuation method requires a number of signals S created by PID **40** in succession. This actuation method assures that actuator **30** does not inadvertently discharge a cloud C. A signal is maintained in line **102** for 2.0 seconds. This line is one input of AND gate **110** having a second input for pulse P in line **82** and an output line **112** which creates a danger signal when gate **110** is enabled. A signal in line **112** indicates that canister **10** is to be discharged. By using time delay device **90**, pulse P in line **82** will first appear as one input of gate **110**; however, the other input **102** is not initiated by a particular pulse P. After pulse P has disappeared, one shot device **100** is then actuated. This occurs quite rapidly. Another signal P in line **82** then creates a danger signal in line **112**. The circuitry illustrated creates a danger signal with two manual actuations of button **44** on PID **40** within two seconds. That is timing only illustrative. The same type of circuitry could be employed for counting several pulses in a relatively short period of time to create a danger signal in line **112**. It is convenient to illustrate the concept of two identification signals within about 2.0 seconds to disclose the concept of preventing actuator **30** from malfunctioning because an inadvertent single operation of button **44**.

To operate plunger **32** when there is a danger signal in line **112**, the circuitry shown in FIG. **2** employs an inverter **120** having an inverted output **122** which shifts to a logic zero when there is a danger signal. This shift of logic on line **122** energizes solenoid **130** having a coil **132** for moving operating rod **134** connected to plunger **32**, as previously described. Rod **134** is biased into the solid line position shown in FIG. **3** by spring **36**. Coil **132** is grounded at line **138**. Solenoid **130** is operated by control circuit **130** when line **122** is grounded. Circuit **140** includes a transistor **142** and power supply for the solenoid. The power supply is preferably a cadmium battery **150** located on cap **20**. In the embodiments shown in FIGS. **4** and **5**, actuator **30** is provided with a plug **160** for connecting power line **162** to output line **164**, which line **164** is connected to the output line **152** of cadmium battery **150**. Line **162** when connected to house current of 110 volts, is provided with a voltage reduction transformer and a rectifier so that the voltage applied at line **162** is approximately 9–12 volts dc. This voltage B+ on line **152** is employed for receiver **50**, as well as filter **60**, amplifier **70**, decoder **80**, time delay **90** and one shot device **100** in accordance with standard practice. In operation, a danger signal at line **122** causes transistor **142** to conduct. This energizes coil **132** of solenoid **130** for propelling plunger **32** downwardly as shown in phantom lines in FIG. **3**.

In FIG. **2A** there is illustrated an option for the circuitry shown in FIG. **2**. A manually manipulated switch **180** connects power supply line **152** with line **182** forming the second input to gate **110**. In this manner, when switch **180** is opened, a logic 0 is applied through resistor **184** to line **182** of gate **110**. By manually closing switch **180**, gate **110** is energized. Whenever a signal appears on line **82** there is created a danger signal in line **112** as previously discussed. Switch **180** could be an enabling switch in any embodiment of the invention. In the particular embodiment illustrated in FIG. **2A**, it is employed as the second enabling input for gate **110** so that a single pulse by the PID **40** will create a protective cloud of gaseous material in response to a danger signal in line **112**. Thus, switch **180** is either a redundant enabling switch or is used to allow operation of actuator **30** with a single pulse at selected times.

Referring now to FIGS. **4** and **4A** cord **200** contains power line **164** and ground line **138** as shown in FIG. **2**. In FIG. **4** plug **202** is adapted for house current; therefore, a unified transformer and rectifier **204** is employed to create the **9-12** pulse dc on line **164**. Plug **202** is referred to in FIG. **2** as plug **160**; however, manually operated plug **160**, in practice, includes a transformer and rectifier. FIG. **5** illustrates the invention mounted by spring clips **210** into opening **212** of a motor vehicle. Plug **220** for cord **200** is used to connect the battery line **162** with power line **164** in cord **200**. When plugs **202** or **220** is employed, the battery **150** may be omitted from actuator **30**. However, in practice, cadmium battery **150** is used as a backup and a redundant power supply when the present invention is mounted in a domicile or other protected building and connected with a plug **202** or used in a motor vehicle and connected with a plug **220**. Cloud C is schematically illustrated in FIG. **5**. Protective cloud C is directed from opening **16** in the various embodiments so far described.

In FIGS. **6** and **6A**, canister **10** is mounted adjacent entrance door D in a bracket or box **250**. This box is secured to the wall adjacent door D, as shown in FIG. **6**. This embodiment merely places a canister **10** in bracket or box **250** secured at door D. A person in another room activates canister **10** by depressing button **44** on PID **40**, as previously described. FIG. **7** shows a slight modification of the invention wherein tube **260** is placed in opening **16** for directing cloud C to a particular area. Such tube is often employed in aerosol containers for directing the contents of a container to a particular remote location. Receptacle **270** is adjacent door D as shown in FIG. **6** or in a vehicle as shown in FIG. **5**. Plugs **202**, **220** can replace a cadmium battery **150**, which is preferred in the invention. Although an electrical solenoid is shown, a mechanical trip mechanism could be activated by the proper code on signal S as a substitute for the electrical solenoid **32**.

Having thus described the invention, the following is claimed:

1. An actuator for a personal protective spray canister having a container means for holding a pressurized protective material capable of being propelled in a gaseous cloud to at least partially disable a person and a manipulative valving device protruding outwardly from said container means, with said valving device having an outlet for directing said gaseous cloud from said container means and a valve element movable between a first biased normal position closing said outlet and a second depressed operative position opening said outlet to allow said material to be propelled from said container means as said cloud, said actuator comprising: a radio frequency receiver means for detecting and receiving a coded radio frequency signal, a decoder means for creating an identification signal when said receiver means receives a radio frequency signal with a preselected code, mechanical means for moving said valve element into said second depressed, operative position in

response to a danger signal, means for creating said danger signal in response to a given number of identification signals received within a given time, electrical means for providing power to operate said mechanical means to depress said valve element and means for mounting said actuator onto said container with said mechanical means operatively associated with said valve element.

2. An actuator as defined in claim **1** including a releasable cap having a cylindrical skirt and forming said mounting means.

3. An actuator as defined in claim **2** wherein said cap has an end wall and means for mounting said mechanical means on said end wall.

4. An actuator as defined in claim **3** wherein said radio frequency receiver means includes an antenna as a part of said cap.

5. An actuator as defined in claim **2** wherein said electrical power means is a battery mounted on said cap.

6. An actuator as defined in claim **5** wherein said radio frequency receiver means includes an antenna as a part of said cap.

7. An actuator as defined in claim **5** where said given number is at least 2 and said given time is less than about 2.0 seconds.

8. An actuator as defined in claim **2** wherein said radio frequency receiver means includes an antenna as a part of said cap.

9. An actuator as defined in claim **8**, where said given number is at least 2 and said given time is less than about 2.0 seconds.

10. An actuator as defined in claim **2** including means for counting identification signals and triggering said means for creating said danger signal when said counting means reaches said given number within a selected time.

11. An actuator as defined in claim **10** where said given number is at least 2 and said given time is less than about 2.0 seconds.

12. An actuator as defined in claim **10** including a releasable cap having a cylindrical skirt and forming said mounting means.

13. An actuator as defined in claim **12** wherein said given number is one and including means for selectively activating said danger signal creating means.

14. An actuator as defined in claim **2** where said given number is at least 2 and said given time is less than about 2.0 seconds.

15. An actuator as defined in claim **2** wherein said given number is one and including means for selectively preventing said identification signals from activating said danger signal creating means.

16. An actuator as defined in claim **15** wherein said selectively preventing means is a manually operated switch.

17. An actuator as defined in claim **2** wherein said given number is one and including means for selectively preventing said identification signals from activating said danger signal creating means.

18. An actuator as defined in claim **17** wherein said selectively preventing means is a manually operated switch on said cap.

19. An actuator as defined in claim **2** wherein said mechanical means is a plunger movable into an extended position upon creation of said danger signal.

20. An actuator as defined in claim **19** wherein said mechanical means includes a solenoid powered by said electrical means and energized in response to said danger signal.

21. An actuator as defined in claim **2** wherein said mechanical means is a plunger movable into an extended position upon creation of said danger signal.

22. An actuator as defined in claim **2** wherein said mechanical means includes a solenoid powered by said electrical means and energized in response to said danger signal.

23. An actuator as defined in claim **1** where said given number is at least 2 and said given time is less than about 2.0 seconds.

24. An actuator for a personal protective spray canister having a container means for holding a pressurized protective material capable of being propelled in a gaseous cloud to at least partially disable a person and a manipulative valving device protruding outwardly from said container means, with said valving device having an outlet for directing said gaseous cloud from said container means and a valve element movable between a first biased normal position closing said outlet and a second depressed operative position opening said outlet to allow said material to be propelled from said container means as said cloud, said actuator comprising: a releasable cap having a cylindrical skirt means for mounting on said container means over said valve element and mechanical means on said cap for moving said valve element into said second position in response to a danger signal created by a remotely created signal having a preselected code and received by said cap.

25. An actuator as defined in claim **26** wherein said code is a binary code.

26. An actuator as defined in claim **24** wherein said code is a part of an high frequency electromagnetic signal.

27. An actuator as defined in claim **24** wherein said mechanical means is a solenoid mounted in said cap and having a plunger for moving said valve element into said second position in response to said danger signal.

28. An actuator for a personal protective spray canister having a container means for holding a pressurized protective material capable of being propelled in a gaseous cloud to at least partially disable a person and a manipulative valving device protruding outwardly from said container means, with said valving device having an outlet for directing said gaseous cloud from said container means and a valve element movable between a first biased normal position closing said outlet and a second depressed operative position opening said outlet to allow said material to be propelled from said container means as said cloud, said actuator comprising:a cap including means for receiving a remotely created coded signal having a preselected code and mechanical means for moving said valve element into said second position in response to a danger signal created upon receipt of said remotely created coded signal.

29. An actuator as defined in claim **28** wherein said cap is cylindrical and includes means for mounting said receiving means and mechanical means on said cap and means for mounting said cap onto said container means.

30. A method of operating a personal protective spray canister having a container means for holding a pressurized protective material capable of being propelled in a gaseous cloud to at least partially disable a person and a manipulative valving device protruding outwardly from said container means, with said valving device having an outlet for directing said gaseous cloud from said container means and a valve element movable between a first biased normal position closing said outlet and a second depressed operative position opening said outlet to allow said material to be propelled from said container means as said cloud, and a cap mounted on said container means, said method comprising the steps of providing mechanical means in said cap for

moving said valve element into said second position and moving said valve element into said second position in response to a danger signal created by a remotely created trigger signal having a preselected code.

31. A method as defined in claim **30** including the further step of creating said trigger signal as a radio frequency carrier with said preselected code being a binary code transmitted by said carrier.

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